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The Effect of Cognitive Load on Illusory Correlation

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THE EFFECT OF COGNITIVE LOAD
ON ILLUSORY CORRELATION

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Table of Contents

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List of Tables and Figures

THE EFFECT OF COGNITIVE LOAD

ON ILLUSORY CORRELATION

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Abstract

This study investigated two theories of illusory correlation in social judgment by examining how varying the level of cognitive load during encoding of social stimuli affected the amount of illusory correlation. If the level of illusory correlation increases in a monotonic relationship with increasing cognitive load, then this type of increase would provide evidence for the distinctiveness-based view of illusory correlation (Hamilton & Gifford, 1976); however, if levels of illusory correlation show a curvilinear relationship, this relationship would provide support for the differentiated meaning view (Haslam, McGarty, & Brown, 1996). Cognitive load was manipulated by having participants perform an auditory secondary task while stimuli were presented and the level of illusory correlation was examined after low, medium, and high levels of cognitive load. The findings failed to provide support for either the distinctiveness-based or the differentiated meaning view. However, there was some indication that more illusory correlation was present in the high cognitive load condition than in low load condition.

Chapter 1

Introduction

Although we are motivated to represent the world as accurately as possible, our perceptions of the world are not always completely accurate. One type of false perception is reflected in biased judgments of the relationship between two events. This bias is called illusory correlation. Illusory correlation is defined by Chapman (1967) as "the report by observers of a correlation between two classes of events which in reality (a) are not correlated or (b) are correlated to a lesser extent than reported" (p.194).

The illusory correlation bias has been demonstrated in a variety of social and clinical judgments. For example, Hamilton and Gifford (1976) showed that people overestimate how often infrequent negative behaviors and minority group members occur together. They suggested that this illusory correlation bias could lead to the formation of social stereotypes. Chapman and Chapman (1967) conducted a study in which they examined the effects of illusory correlation on clinical judgment using the Draw-A-Person (DAP) test. The participants were naïve students who knew nothing about the DAP test. They first examined a number of DAP drawings with two diagnostic statements at the bottom, such as "He is worried about how manly he is" or "He is suspicious of other people." This task was used to provide the participants with "clinical experience." They were then given a questionnaire and asked about the characteristics of the drawings made by men with each type of problem (i.e., Some of the pictures were drawn by men with the following problems: *He is worried about how manly he is.* The pictures drawn by these men were more often characterized by ____?). In five out of the six studies there was no actual relationship between the occurrence of any symptom and any drawing characteristic in the materials seen by the participants in the first part of the experiment. Results showed illusory correlation bias between symptoms and drawing characteristics. For example, participants reported broad-shouldered muscular figures more often as a correlate to the symptom "He is worried about how manly he is" than any of the other symptoms. The obvious concern here is that clinicians should be made aware of the possible effects of illusory correlation in the interpretation of subjective tests. In fact, Chapman and Chapman state that some of the effects of illusory correlation can be negated by awareness. If clinicians are aware of illusory correlation and the pitfalls associated with it then they may be able to avoid some of these false beliefs. However, awareness alone will not overcome all of the effects of illusory correlation.

Gyns, Willis, and Faust (1994) conducted a study to determine whether illusory correlation also occurs in judgments made in the school setting. The study addressed several questions. The first question was whether school psychologists would perceive an illusory relationship between intersubtest scatter on the WISC-R and a learning disability? The second question was whether this illusory correlation would persevere even if other valid information was present (i. e., academic data)? The experimenters predicted that school psychologists reviewing a case with more intersubtest scatter would be more likely to diagnose a learning disability, regardless of the academic data available. School psychologists were given scores on the Wechsler Intelligence Scale for Children-Revised (WISC-R), the Woodcock Johnson Psychometric Battery (WJPB), the Conner's Behavioral CheckList (CBCL), and some identifying information about the examinee.

The amount of scatter between the WISC-R subtests was divided into low, medium, and high. Academic achievement was divided into low and average. After reviewing the data, the psychologists were asked to indicate the probability that the student had a learning disability and the amount of confidence they had in their diagnosis. The results showed an increase in learning disability diagnosis when there was more scatter within the subtests. These results show illusory correlation bias in the school psychologist's judgment, because there was no relationship between learning disability and intersubtest scatter (Kaufman, 1979; Kavale & Forness, 1984). Moreover, an illusory correlation effect in their judgment was seen regardless of which academic achievement level was used. Thus, illusory correlation affected the clinical judgment of the school psychologists even when there were valid cues pointing toward the accurate diagnosis.

In the real world we are rarely in a situation where one task has our undivided attention. For example, when you are driving down the interstate and trying to tune your radio station, your attention is divided. Likewise when you go to buy a car, you try to think through the deal that is being offered to you, but the sales person is constantly bombarding you with information. This makes it difficult for you do concentrate on deciding whether or not this deal is a good one. Individuals have limited attentional resources, so the more resources a person uses when tuning the radio, the less available for driving. A related concept, cognitive load, refers to the amount of attentional resources required to perform current tasks. Divided attention increases cognitive load because individuals must allocate their available attentional resources to two or more tasks. Relative to divided attention, focused attention is less demanding because all resources can be allocated to one task.

Theorists have suggested that illusory correlation bias is influenced by the amount of attentional resources available for processing event co-occurrence evidence or data. Some research suggests that there is a curvilinear relationship between illusory correlation and cognitive load (Spears & Haslam, 1997); that is, relatively little illusory correlation is seen with low cognitive load, but as load increases so does the degree of illusory correlation. Finally, with high cognitive load requirements the amount of illusory correlation decreases. Spears and Haslam provide an explanation for why this curvilinear relationship is present. They suggest that under conditions of low cognitive load participants can focus on the task at hand and should therefore show little evidence of illusory correlation. In contrast, conditions of moderate cognitive load prevent on-line processing, and as participants attempt to form meaningful differences between groups we will see evidence of illusory correlation bias. In high cognitive load conditions, even the process of seeking meaningful differences will be undermined, because little attention can be given to this process. Consequently, there would be a decrease in the illusory correlation effect. The suggestion is that there is an optimal attentional window where stereotyping due to illusory correlation is most likely to occur. However, little research has looked at the effects of cognitive load on illusory correlation. Moreover, most of the studies that do investigate this issue have questionable methods of manipulating cognitive load. For example, in an unpublished study by Slusgosky, Sarson, and Krank (1991), load was manipulated by doubling the number of stimulus sentences from 36 to 72. While this method may increase task difficulty, it is not a good way of manipulating cognitive load, because all of the participant's attention is still focused on just one task.

The present experiment examined how illusory correlation is related to variations in cognitive load by examining the amount of illusory correlation in contingency judgments following three encoding conditions: low cognitive load, medium cognitive load, and high cognitive load. In the low cognitive load condition, participants concentrated on the group-behavior statements as they were presented. In the medium cognitive load condition, participants listened to an audio recording while they were looking at the group-behavior statements. These participants were asked to make a response each time they heard an odd digit. In the high cognitive load condition, participants also listened to a recording while they looked at the group-behavior statements, but this group was asked to respond every time they heard a string of three consecutive odd digits. It was expected that the results of this experiment would provide useful data about the magnitude of illusory correlation in contingency judgment under less than favorable encoding conditions. Given the effect this bias can have on the "real world" decisions psychologists make about the people they serve, gaining a better understanding of the processes involved in this judgment bias is important. Through knowledge of these processes we can perhaps help people to reduce the effects of illusory correlation in their judgments.

Chapter 2

Literature Review

The Illusory Correlation Effect

Chapman (1967) reported that people's judgments often contain errors and biases. One type of systematic error that may be seen is called illusory correlation. Chapman conducted a study to look at this bias in judgment. In his experiment, participants were presented pairs of words projected on a screen. All of the words presented on the left side of the screen were paired equally often with all of the words presented on the right side of the screen. The length of the words varied, and there were more short words than longer words. After being exposed to all of the word pairs, subjects were asked to judge how often the word pairs were seen. The correct relationship between any two words was 33 1/3%. However, Chapman's results showed that the subjects overestimated the frequency of co-occurring long words. Chapman concluded that the overestimation of the pair's frequency was due to their "paired distinctiveness" in memory. He hypothesized that the co-occurrence of less frequent stimuli results in a more distinctive memory trace for these pairs, which in turn leads to an overestimation of the frequency of co-occurrence of the stimuli, i.e., an illusory correlation bias.

Hamilton and Gifford (1976) pursued this theory in a social judgment context. They tested the theory that observers would overestimate the co-occurrence of statistically infrequent group-behavior pairs. In their experiment, participants were shown a series of positive and negative behaviors of members of two groups (Group A &

Group B). For example, "Joe, a member of Group A, steals." There were more members of Group A than Group B, and more of the behaviors were positive than negative. However, the proportion of positive to negative behaviors was the same for both groups, so there was no actual correlation between group membership and type of behavior (positive or negative). After being presented with a number of statements about the group members, participants were given a list of behaviors and were asked to indicate which behaviors were associated with each group. Participants attributed more negative behaviors to the smaller group, thus revealing an illusory correlation effect in their judgment. In a second experiment, the distribution of the desirable and undesirable traits was changed. Specifically, desirable traits were less frequent than undesirable traits. The results of this experiment showed a greater attribution of the less frequent desirable traits to the minority group. Thus, the illusory correlation bias was not a function of the participant's predisposition to judge the minority group more negatively. In line with Chapman (1967), Hamilton and Gifford interpreted their findings in light of a distinctiveness effect on memory. According to the distinctiveness-based theory, the combinations of minority group and negative behaviors occur least often and so were distinctive in memory. Since these pairs were more distinctive in memory they are more easily retrieved and their frequency was overestimated.

At this point, researchers still did not know when in the memory process illusory correlation occurred. Did the bias take place as people try to encode the information, or did it occur as people pull information from memory and make judgments? Hamilton, Dugan, and Trolier (1985) conducted a study to see if illusory correlation biases formed at encoding or at retrieval. In their first experiment, participants were divided into three groups. One group received a procedure identical to that of Hamilton and Gifford (1976), i.e., participants in this group read a series of stimulus sentences describing desirable and undesirable behaviors performed by members of Group A and Group B. Participants in the second group saw the statements and were then shown a frequency table summarizing the information they had just read. Participants in the third group were shown only the summary table. All of the participants were then given the task of indicating how often Group A and Group B members were paired with desirable and undesirable traits. If illusory correlation bias occurs at the encoding stage, then the table only group should show no illusory correlation. In this condition the information is presented clearly in a table and should be easily and accurately encoded into memory. On the other hand, if illusory correlation is present in this condition, its presence would suggest that illusory correlation could occur during the retrieval stage. Hamilton et al. hypothesized that the two groups who received the serial stimulus sentence presentation would show the illusory correlation bias in their group evaluations but that the summary table only group would not. Results from the first group were similar to the results found by Hamilton and Gifford (1976); i.e., a strong illusory correlation effect was noted. In the stimulus sentences plus summary table condition a significant, but slightly smaller illusory correlation effect was seen. However, in the summary table only condition illusory correlation was not present. The results thus support the idea that the illusory correlation stems from biases in the encoding of stimulus items and not from biases that occur at the time judgments are made.

An alternative to the hypothesis that illusory correlation is due to the "paired distinctiveness" of stimuli is the idea that the frequency of co-occurrence of the majority group and majority behavior is overestimated (Rothbart, 1981). The logic is that since positive behaviors and Group A members occur most often, these pairs will be easier to recall and subjects will judge Group A to be more favorable than Group B. Although this view is similar to the paired distinctiveness view, the question is which category of stimulus sentences is most available in memory. Hamilton and Gifford (1976) cast some doubt on this view. When participants were given the task of assigning group membership to behavior descriptions, participants assigned a disproportionate number of undesirable traits to Group B. However, participants did not assign a disproportionate number of desirable traits to Group A, thereby supporting the distinctiveness-based view. Hamilton et al. (1985) provided further evidence for this view. Participants were first presented with the group-behavior statements. After the presentation of the sentences, participants were given a free-recall task, a frequency estimation task, and an affective rating task. For the free-recall task participants were given a blank piece of paper and asked to write down all of the group-behavior statements they could remember from the study list. Participants were also encouraged to write down a behavior even if they couldn't remember which group it was paired with. After they finished with this task, participants were asked to go back to any line where they wrote a behavior, but couldn't remember the group membership and were instructed to assign group membership to these behaviors even if it meant guessing. The researchers hypothesized that there would be a higher proportion of sentences recalled for Group B/undesirable behaviors than for any of the other three possible combinations (Group A/desirable, Group A/undesirable, and Group B/desirable). The results supported the hypothesis by showing that participants assigned more undesirable behaviors to Group B than any of the other three combinations. The results provided evidence for the distinctiveness-based view and failed to support the alternative view that both majority group positive and minority group negative behaviors are equally as easy to retrieve from memory (cf. Rothbart, 1981).

Johnson and Mullen (1994) attempted to provide further evidence for the "paired distinctiveness" view. They conducted a study similar to that of Hamilton and Gifford (1976), but varied the way they measured illusory correlation. Specifically, Johnson and Mullen presented their sentences on a computer with an exposure time of 8 seconds. The statements were then presented again without group identification (e.g., Arnold, a member of Group___, carved a statue for his town's park), and the participants were asked to indicate whether the statement belonged to a member of Group A or Group B. Johnson and Mullen noted that one gauge to cognitive accessibility is the speed with which information can be retrieved. Thus, if the distinctiveness based-view is accurate, the response time for attributing negative behaviors to group B should be shorter than response time for any of the other combinations. Participants were therefore asked to push either the "A" or "B" key depending on which group they thought the trait was associated with, and the computer measured the latency of their responses. The findings revealed an illusory correlation bias with a greater attribution of negative behaviors to the minority group (Group B). The study also showed that response times were faster when participants assigned negative behaviors to group B, indicating that these pairs were more readily accessible in memory.

The distinctiveness-based approach suggests that the illusory correlation effect is due to a memory bias. The rare, unique things in life seem to "stick out" in our memory, which causes them to be more easily retrieved. However, distinctiveness-based process may not be the sole cause of illusory correlation. For example, McGarty, Haslam, Oaks, and Turner (as cited in Spears & Haslam, 1997) showed participants a list of behavior statements about individuals, but did not indicate group membership. After all the stimulus statements were presented, participants were told that in the real world Group A is larger than Group B so more of the statements were about Group A than Group B. They were also told that there were more desirable statements than undesirable statements. Participants subsequently assigned distinctive negative behaviors to the smaller group. In this case however, this illusory correlation bias could not be due to the overrepresentation of distinctiveness pairings because the information about group membership was not included in the stimulus statements. These results suggest that the distinctiveness-based view cannot account for all situations where illusory correlation effects are seen.

Recent research has shown that social expectations may also play a role in illusory correlation bias in judgment (McGarty & de la Haye, 1997). Proponents of "differential meaning approach" ask the question "in what ways is it possible to see the stimuli as favoring the majority over the minority?" McGarty and de la Haye propose that people may generate at least two sets of hypothesis in response to this question in the typical illusory correlation task. In the first case, Case X, the participants could have the following hypotheses:

Hx1 Group A members are good and Group B members are bad

Hx2 Group B members are good and Group A members are bad

In the typical illusory correlation experiment a greater number of statements support Hx1 (18 positive for Group A, and four negative for Group B) than support Hx2 (eight positive for Group B, and nine negative for Group A). If participants generate this hypothesis then they would perceive Group A as better than Group B.

For the second case, Case Y, participants could have the following hypotheses:

Hy1 Group A is more positive than negative

Hy2 Group B is more positive than negative

In this case, the 18 positive behaviors for Group A are significantly greater then the nine negative for Group A. However, the eight positive behaviors for Group B are not significantly larger than the four negative behaviors for the group. So participants would accept hypothesis Hy1. These cases show two ways a participant may go about establishing a difference between Group A and Group B. Either case could produce results similar to those traditionally seen in the illusory correlation paradigm and would be the result of a search for social differences between the groups, not paired distinctiveness.

In line with the differentiated meaning view, Haslam, McGarty, and Brown (1996) have shown that if there is readily apparent meaningful difference between groups, these hypotheses won't be generated and the illusory correlation effect will be reduced. Haslam et al. used two conditions in their experiment. The first condition was similar to the original Hamilton and Gifford (1976) procedure. In the second condition, participants were told that Group A consisted of right-handed people and Group B consisted of left-handed people. Since there are more right-handed people than left-handed people in the real world, Group A is bigger than Group B. The prediction was that if participants were told the difference between the two groups in advance, then they would not have to search for a meaningful difference, and thereby the illusory correlation effect would be reduced. The results revealed an illusory correlation bias in the first condition, but in the second condition (right vs. left-handedness) the illusory correlation effect was eliminated, thus supporting the view that the illusory correlation comes from the process of establishing differential meaning between the groups. In the traditional paradigm, participants are not told the difference between the two groups and they must use the only information they have available, the desirability/undesirability of group behavior to differentiate between the groups. However, if differentiating meaning is already provided, participants apparently don't need to use the desirability of the groups as the differentiating factor.

Illusory Correlation and Attentional Demands

Despite their differences, both the distinctiveness-based view and the differentiated meaning view see encoding as the critical stage of processing for producing an illusory correlation bias. Dividing attention between tasks during encoding requires greater cognitive resources than when attention can be focused on one task. Moreover, people have limited resources available to perform cognitive tasks and as cognitive load increases it becomes harder to complete these cognitive tasks successfully. This situation can potentially lead to greater error in memory and judgment. Spears and his colleagues (Spears & Haslam, 1997; Berdsen & Spears, 1997) have suggested that higher levels of cognitive load during encoding may increase the illusory correlation in judgment.

According to the distinctiveness-based view, illusory correlation bias should not be present in conditions where all group-behavior stimuli can be recalled. Illusory correlation will only come into play in situations of uncertainty or overload. Thus, the greater the cognitive load the more likely it will be that a person will have to rely on distinctive stimuli to make a judgment. The implication is a monotonic relationship between cognitive load and illusory correlation (Spears & Haslam, 1997). Specifically, under low cognitive load, participants should be able to recall most of the stimuli and make fairly accurate judgements. As cognitive load increases, participants will have to rely more and more on distinctive stimuli to make their judgments, thus leading to an increase in illusory correlation.

In contrast, the differentiated meaning view implies that the illusory correlation effect will be greater under moderate cognitive load than under low or high cognitive load conditions. Under low cognitive load conditions, participants should be able to focus on the group-behavior statements and are more likely to encode this information accurately. Under moderate load conditions, participants can't devote the necessary attention to encoding the stimulus sentences; therefore their tendency to look for differences between the two social groups becomes prevalent (Spears & Haslam, 1997). This condition would lead to an increase in illusory correlation bias. Under high cognitive load conditions even less attention can be given to details; furthermore, if searching for differentiated meaning between groups is an effortful and meaningful process, it will also be undermined thus weakening the illusory correlation effect. In other words, when high levels of cognitive load are introduced the illusory correlation effect will disappears because participants are unable to encode the group behavior statement and the effortful process of finding meaningful differences cannot occur.

There have been several studies claiming to study the effects of cognitive load on illusory correlation. These studies provide some evidence for the idea that there is a curvilinear relationship between illusory correlation and cognitive load.

Spears and Haslam (1997) manipulated cognitive load by varying the presentation duration of stimuli. In one condition, participants were exposed to each group-behavior statement for 2.5 seconds; in the other two conditions, exposure time was 5 seconds and 10 seconds respectively. The results showed that only the 5-second exposure time group had a significant illusory correlation effect. No effect was seen for the 2.5 seconds and 10 seconds exposure time groups. This manipulation therefore resulted in a curvilinear relationship with significantly less illusory correlation in the low and high cognitive load conditions than in the moderate cognitive load condition.

Stroessner, Hamilton, and Mackie (1992) attempted to manipulate cognitive load using a mood induction task. Three different mood states were induced using short video segments. The positive mood video consisted of a performance by a stand-up comedian. The neutral mood video was a segment of a National Geographic program about dormant volcano exploration. The negative mood video was about a child abuse case that resulted in the child's death. Participants were then shown the standard group-behavior stimuli sentences. In the neutral mood condition an illusory correlation bias was observed; however, in both the negative mood and positive mood conditions no illusory correlation bias was reported. These results again support the idea of a curvilinear relationship between illusory correlation and cognitive load.

Finally, in an unpublished study, Slugoski, Sarsan, and Krank (as cited in Spears & Haslam, 1997) manipulated load by doubling the number of stimulus sentences. They found no increase in illusory correlation in frequency or evaluative trait ratings in the double stimulus sentences condition. Moreover, they found significantly less illusory correlation on a cued recall task in the double stimulus sentences. This decrease in illusory correlation for the two highest load conditions supports the idea that there is a curvilinear relationship between cognitive load and illusory correlation.

While these experiments do provide some evidence for a curvilinear relationship between cognitive load and illusory correlation, there is some concern about how they manipulate the cognitive load of the participants. Slugoski, Sarsan, and Krank (as cited in Spears & Haslam, 1997) manipulated cognitive load by doubling the set size of the stimulus sentences, and Spears & Haslam (1997) manipulated cognitive load by varying presentation duration of the stimulus sentences. Varying the stimulus set size would increase overall memory load, but would not necessarily produce an increase in cognitive load during encoding. Similarly, manipulating presentation duration would vary the time to encode the stimuli, but not necessarily the resources available for encoding these items. Likewise, Stroessner et al. (1992) claim that by manipulating mood they are manipulating cognitive load. However, this procedure may cause participants to focus on behaviors consistent with their mood state. In sum, it is not completely clear that the procedures used in these earlier studies were acceptable ways to manipulate cognitive load. For this reason, additional research should be done to examine the relationship between illusory correlation and cognitive load using procedures that more precisely manipulate cognitive load requirements during encoding.

Slugoski and colleagues (as cited in Spears & Haslam, 1997) used a concurrent digit task to manipulate cognitive load. This procedure had the participants perform a secondary task as they were encoding the group-behavior statements. However, this experiment was not published. Mutter (2000) has conducted a procedure manipulating cognitive load requirements during encoding. In her experiment, she used a procedure similar to Hamilton & Gifford's (1976), but introduced a divided attention manipulation. Participants in a low distraction condition were allowed to concentrate solely on the stimuli sentences during encoding, whereas participants in a distraction condition performed a second task while encoding the stimuli. Specifically, these participants were given a four digit odd number before any sentences were presented and were instructed to add two to this number every time they saw a new statement. Illusory correlation in memory was measured using a trait-recognition task and illusory correlation in evaluative judgment was measured using trait frequency estimation and affective rating tasks. For the trait recognition task, participants were asked to determine whether a trait had been assigned to Group A, Group B, or was a new trait that was not presented in the previous study phase. For the trait-frequency task, participants were told the actual number of sentences that were presented describing Group A and were asked how many of the statements had been desirable and how many had been undesirable. A similar sheet was provided for Group B. In the affective rating task, participants were asked to indicate how much they liked members of Group A and members of Group B using a rating scale ranging from 1 (not at all) to 7 (very much). The data from the trait frequency and affective rating tasks showed an illusory correlation effect in the distraction condition, but not in the no-distraction condition. The findings for the no distraction and distraction conditions provide support for the idea that increasing cognitive load increases illusory correlation (Spears & Haslam, 1997). However, this experiment did not include a high cognitive load condition and thus provides no way to distinguish between the monotonic relationship between load and illusory correlation proposed by the distinctiveness-based view and the curvilinear relationship proposed by the differentiated meaning view.

In the present research, low, medium, and high cognitive load conditions were included in order to distinguish between these two relationships. Specifically, participants in a low cognitive load condition concentrated fully on the stimulus sentences as they were presented. Those in a medium cognitive load condition listened to a series of numbers as they read the stimulus sentences and were required to count the number of odd digits they heard (Park, Smith, Dudley, & Lafronza, 1989). Participants in a high cognitive load condition also listened to a string of numbers as they read the stimulus sentences, but they were required to count the number of strings of three consecutive odd digits they heard (Mulligan & Hartman, 1996). This task was a more difficult one because it required participants to keep the previous digits in memory and make comparisons each time a new digit was presented. Afterwards, illusory correlation was measured using the trait recognition, trait frequency, and affective rating tasks used in Mutter (2000). The trait recognition task was used to measure illusory correlation in memory, with higher phi coefficients indicating more illusory correlation bias. The trait estimation and affective rating tasks were used to measure illusory correlation in evaluative judgment, again with higher phi coefficients indicating more illusory correlation bias.

The main hypothesis was that the amount of cognitive load at encoding would influence the amount of illusory correlation seen in both memory and evaluative judgment. If the distinctiveness-based view is correct, a monotonic relationship between cognitive load and illusory correlation should be observed; that is, under low cognitive load, participants should be able to effectively encode and recall the stimuli. As a result, their judgments should be fairly accurate resulting in low phi coefficients for the trait recognition and trait frequency measures and little illusory correlation. As cognitive load increases, participants in the medium and high cognitive load conditions should be less able to encode all the stimuli and should have to rely to a greater extent on the distinctiveness of stimuli in memory. This effect would lead to higher phi coefficient values and a monotonic increase in illusory correlation across all of the three cognitive load conditions.

If the differentiated meaning view is correct, a curvilinear relationship between cognitive load and illusory correlation should be observed. More specifically, in the low divided attention condition, there should be little illusory correlation bias since the participants should be able to recall most of the stimuli and make fairly accurate judgments. The result would be low phi coefficients for the trait recognition and trait frequency measures. When cognitive load is at a moderate level there should be an increase in the phi values indicating an increase in the amount of illusory correlation bias present. Information cannot be encoded as thoroughly in the medium condition, because participants were not able to devote all of their attention to reading the stimulus sentences. However, the moderate load should not prevent participants from searching for differences between the two social groups. In the high cognitive load condition, there should be a decline in the amount of illusory correlation bias recorded. With a large portion of the cognitive resources being used for the secondary task, participants should have few remaining resources to devote to encoding the stimulus sentences or to differentiating social differences between the groups. For this reason phi coefficients for the trait recognition and trait frequency measures should decline and illusory correlation effects should be eliminated. Thus, the critical finding distinguishing between the two theories comes from the high cognitive load condition. If the phi coefficients continue to increase in this condition relative to the medium cognitive load condition, evidence for the distinctiveness-based view would be provided. However, if the phi coefficients decline in this condition, relative to the medium cognitive load condition, then the evidence would support the differentiated meaning view.

Chapter 3

Method

Participants and Design

Seventy-two young adults were recruited from psychology classes and were given course credit for their participation in the experiment. Twenty-four participants were randomly assigned to each of the three cognitive load conditions (low, medium, and high). Two different study lists (List A and List B) were used and three different types of illusory correlation tests were given (trait recognition, trait frequency, and affective rating). Test Order 1 was trait recognition, frequency estimation, affective rating; Test Order 2 was trait recognition, affective rating, frequency estimation. Six participants were randomly assigned to each study list/test order combination.

Materials

Stimulus materials for the illusory correlation tasks were the same as those used in Mutter (2000). The study lists in this earlier study were constructed of forty-eight group-trait adjective statements that provided information about a personality trait of a particular group member. The trait was either desirable or undesirable and the person was either a member of group A or a member of group B (e.g., "Alex, a member of group A, is polite," or "Gary, a member of Group B, is hostile"). Of the forty-eight names on each list, thirty-six were randomly assigned to members of group A and twelve to members of group B. Personality traits assigned to these group members were selected from an initial pool of trait adjectives taken from the 1st (desirable traits) and 4th

(undesirable traits) quartiles of Anderson's (1968) likeableness ratings for personality trait words using the following of restraints. Only adjectives that contained no hyphens or prefixes and that were between four and ten letters in length, with a background frequency ranging from 4 to 100 occurrences per million (Francis & Kucera, 1982), were selected. A total of sixty-four desirable and thirty-two undesirable trait adjectives were randomly chosen from this pool of traits. For each of two study lists, Group A was three times larger than group B, 36 and 12 members, respectively, and both groups had twice as many desirable traits as undesirable. Thus, in both study lists, twenty-four desirable traits and twelve undesirable traits were paired with members of Group A, whereas eight desirable traits and four undesirable traits were paired with members of Group B.

Participants in the low cognitive load condition concentrated fully on the group-trait pairs as they were presented. Participants in moderate and high cognitive load conditions performed a digit-monitoring task as they studied the group-trait pairs. In both conditions, participants heard an audiotape containing a list of 180 digits ranging from 1-10. For the medium cognitive load condition, participants used a manual counter to record each time they heard an odd number. The counter was a small hand-held device that increments by one every time its button is pushed. The digits used in this condition were chosen by selecting the next to last number of the phone numbers listed in a local phone book; the number zero was recorded as the number ten. These numbers were randomly arranged in a list with the constraint that there could be no more than three odd or even numbers in a row. The numbers were read at a rate of approximately 1.5 seconds per number, and the list was repeated to ensure that the recording lasted for the entire duration of the study list.

For the high cognitive load task, participants used the counter to record each time they heard a string of three odd numbers. Thirty-two of these target sequences were randomly dispersed throughout the list. The digits in the target sequences were randomly selected from the set of all odd digits in the numbers 1 - 10. In addition, there were no more than two even digits in a row and an even number preceded each target sequence. Finally, the target sequences had a minimum of one digit and a maximum of five digits between them. To create this list, a grid with 180 slots was constructed. Starting from the first square on the grid, the roll of a die was used to determine the placement of the target sequences. A roll of six was always discarded and the die rolled again. For example, if a three was rolled then three squares would be skipped and the next three boxes would be designated for a target sequence and highlighted. This procedure was repeated until the thirty-two target sequences spaces were placed in the list. The phone book was then used to generate the digits in the list. The next to last digit in the phone number was used with zero again representing the number ten. All of the target sequences were filled in first. When filling in al of the target sequences, all even digits were ignored. Another constraint was that the target sequences could not contain duplicate numbers (i.e., 7, 7, 3 or 9, 1, 1). Omitting duplicates would make the sequence easier to discern. Because this would reduce the amount of attention required to notice the target sequences a modification was made to use when this situation arose. If any target sequence contained duplicates then one of the numbers was changed. When duplicate numbers occurred a quarter was flipped. A head represented the first number and a tail represented the second number. When a head came up then the first number was replaced with the first non-duplicate odd digit in the phonebook. A similar procedure was used when a tail is flipped. After the target sequences were in place, the remaining squares in the grid were filled in following the rules stated above. When the entire list was completed it was recorded at a rate of 1.5 numbers per second. The list was repeated to ensure that it would last the length of the study list presentation. A practice list was created for the Hard and Easy Digit Monitoring Tasks. Each practice list was half the length of the original list and was created in a similar manner.

A trait recognition test was used to measure illusory correlation in memory (e.g., Pryor, 1986); trait frequency estimation and affective rating tasks were used to measure illusory correlation in evaluative judgment. For the trait recognition test, participants were given a list of 96 traits. The list was composed of thirty-two desirable and sixteen undesirable traits presented with either Group A or Group B in the study list, as well as thirty-two desirable and sixteen undesirable traits not presented in the study list. Participants were asked to decide whether a trait was presented with Group A, Group B, or was not presented with either group.

In the frequency estimation task, participants were told the total number of statements describing each group that were presented and were asked to estimate how many of these statements were desirable and how many were undesirable. The participants were told that there were a total of thirty-six statements presented for Group A and that their task was to write their estimate of the number of these statements that were desirable and the number that were undesirable.

For the affective rating tasks participants were asked to rate how they much they liked members of each group. A Likert scale ranging from 1 (not at all) to 7 (very much) was used for this task. Participants completed this scale for group A and for group B.

Procedure

Participants were tested in a session that lasted about one hour. Participants first filled out the consent forms and a biographical questionnaire that was part of the standard procedure associated with Cognition Laboratory experiments. Participants were then given a set of instructions. The set of instructions that the participant received depended on the cognitive load condition to which they were assigned. All participants were given a practice auditory task before the stimulus sentences were presented. Half of the participants in the low cognitive load condition heard the practice list for the medium cognitive load condition and half heard the practice list for the high cognitive load condition. For instructions read to participants see Appendix A.

All participants were then given a practice task to familiarize them with the secondary digit-monitoring task. The Low Cognitive Load group was also given the practice task but did not do the digit monitoring task during study list presentation. Participants then received the list of group-trait statements presented individually at the overall rate of eight-seconds. Each statement appeared for five seconds and a blank screen appeared for three-seconds between each statement. Participants in the moderate and high cognitive load conditions also performed their respective digit monitoring tasks as the statements were presented. The low cognitive load group focused solely on the statements.

After the presentation of the statements, the value on the counters of the medium and high cognitive load groups was noted. All participants then completed the trait recognition task. The trait frequency estimation task and the affective rating task in the appropriate counterbalanced order followed this task. After the completion of the last illusory correlation task, participants were debriefed and dismissed.

Auditory task

To ensure that participants who perform the concurrent auditory task incorrectly were not included in the sample, those who missed the actual total by more than 20 in the medium cognitive load condition and 10 in the high cognitive load condition were replaced. Since participants in the high cognitive load condition heard fewer target sequences than those in the medium cognitive load condition, fewer sequences could be missed. No participants missed the actual total by more than the allotted amount.

Chapter 4

Results

Scoring

The scoring procedure followed closely the procedure used by Mutter (2000). Several dependent measures were obtained from each participant's data. Trait recognition responses were coded as hits (attribution of an original trait to the correct group), mismatch errors (attribution of an original trait to the wrong group), misses (attribution of an original trait to neither group), or false alarms (attribution of a new trait to a group). These responses were further coded into the categories A+ (desirable traits attributed to Group A), A- (undesirable traits attributed to Group A), B+ (desirable traits attributed to Group B), or B- (undesirable traits attributed to Group B). The proportion of responses in each of these categories was obtained by dividing the obtained number of responses by the total number of possible responses in that category (e.g., 10 A+ hits resulted in a proportion of 10/24 = .42; 5 B+ mismatch errors resulted in a proportion of 5/8 = .62, and so on). In addition, a signed phi coefficient was computed using the total number of original desirable and undesirable traits (i.e., hits + mismatch errors) assigned to Groups A and B where phi = (A+ * B-) – (B+ * A-) / SQRT ((A+ + B-) * (A- + B+) * (A+ + A-) * (B+ + B-)). Phi coefficients are a measure of association. Phi coefficients that were significantly greater than zero indicated the presence of an illusory correlation bias.

Frequency estimates for desirable Group A and Group B traits were used to compute the conditional probabilities $p(+/A)$ and $p(+/B)$. The actual value for both of these conditional probabilities are based on the numbers of desirable and undesirable traits originally paired with Group A and Group B. The probability in all three cognitive load conditions was .67. A signed phi coefficient was also computed using the frequency estimates for A+, A-, B+, and B- traits. Finally, a liking index was calculated by subtracting the affective rating for Group A from that for Group B. The lower the index, the less favorable the impression of Group B relative to that of Group A. The significance level was set at $p < .05$ for all analysis of these measures.

Illusory Correlation Measures

Trait recognition. The trait recognition task was used to measure the amount of illusory correlation in memory. First, separate t-tests were done to see whether phi coefficients (phi-mem) were significantly greater than zero. The value of phi-mem for the low cognitive load condition was not significantly different than zero, M=.073, $t(23)$=.916. However, the value of phi-mem for the medium effort condition was significantly different from zero, M=.211, $t(23)$=2.82, as was the value of phi-mem for the high cognitive load condition, M=.266, $t(23)$=2.97. These results suggest that there is no illusory correlation in the low condition, but illusory correlation is present in the medium and high load conditions. A one-way ANOVA was then conducted to see whether these phi scores varied as a function of cognitive load. There was no main effect of cognitive load, $F(2,69)$ =1.47, MSE=.236, and planned comparisons of the means for the low vs. medium, medium vs. high, and low vs. high conditions showed no difference between these conditions. Thus the indication is that the amount of illusory correlation did not vary significantly across the three cognitive load conditions.

Mismatch errors and false alarms were examined next. The mean number of mismatch errors for the three cognitive load conditions are shown in Figure 1. Mismatch errors occurred when one of the original traits (a trait presented in the original list) was assigned to the wrong group (e.g., a trait was presented with a member of Group B, but the participant assigned the trait to Group A). A false alarm occurred when a new trait (a trait not presented in the original list) was assigned to either Group A or Group B. Mismatch errors and false alarms were entered into separate 3 (Cognitive Load Condition: Low vs. Medium vs. High) X 2 (Social Group: A vs. B) X 2 (Trait Type: Desirable vs. Undesirable) ANOVAs. The presence of a significant Social Group X Trait Type interaction would provide evidence for the illusory correlation bias and a significant Cognitive Load X Social Group X Trait Type interaction would indicate that the degree of illusory correlation varied with cognitive load at encoding.

Table 1 shows the ANOVA table for the mismatch errors. The main effect of cognitive load, $F(2,69)=2.66$, $MSE=.106$, was marginally significant, indicating that the number of mismatch errors was somewhat greater in the higher load conditions. There was also a main effect of group, $F(1,69)=14.17$, $MSE=.473$, showing that the number of mismatch errors varied between Group A and Group B. Specifically, a higher percentage of mismatch errors occurred for traits originally presented with Group B. The Group X Cognitive Load interaction, $F(2,69)=1.86$, $MSE=.062$, was not significant showing that there was no variation in the number of errors for the groups across the cognitive load conditions. There was no main effect of trait type, $F(1,69)=2.08$, $MSE=.060$, indicating that the number of mismatch errors did not vary for desirable and undesirable traits, and there was no significant interaction between trait type and cognitive load , $F(2,69)=1.29$, *MSE*=.038. This latter finding indicated that the number of mismatch errors was similar for both desirable and undesirable traits across the three cognitive load conditions. As expected, there was a significant Group X Trait Type interaction, $F(1,69)=14.91$, *MSE*=1.51, revealing the presence of illusory correlation. A one-way ANOVA of mismatch errors for Group B, $F(1,71)=16.40$, *MSE*=.066, $p < .0001$, indicated a higher proportion of desirable Group B traits was assigned to Group A. A one-way ANOVA of mismatch errors for Group A, $F(1,71)=7.54$, *MSE*=.064, $p <.008$, indicated a higher proportion of undesirable Group A traits was assigned to Group B. However, there was no interaction between group, trait type, and cognitive load, $F(2,69)=.917$, *MSE*=.093, showing that the level of illusory correlation did not vary as a function of cognitive load.

The false alarms for the three cognitive load conditions are shown in Figure 2, and the ANOVA table for these data is provided in Table 2. The analysis of false alarms produced no main effect of cognitive load, $F(2,69)=.412$, *MSE*=.023, indicating that the number of false alarms did not vary as a function of load during encoding. There was a main effect of group, $F(1,69)=8.07$, *MSE*=.186, with more new traits being assigned to Group A than to Group B. However, interaction between group and cognitive load was not significant, $F(2,69)=2.813$, *MSE*=.065, showing that the number of false alarms did not vary for Group A and Group B across the cognitive load conditions. There was a main effect of trait type, $F(1,69)=23.79$, *MSE*=.222, with more desirable false alarms than undesirable false alarms, and the trait type by load interaction was not significant, $F(2,69)=.294$, *MSE*=.012. Thus, the number of false alarms did not vary between Group A and Group B across the cognitive load conditions. There was a significant interaction between group and trait type, $F(2,69)=13.406$, *MSE*=1.056, again indicating a significant illusory correlation bias. Specifically, a one-way ANOVA of the false alarms for Group A indicated there was a higher proportion of new desirable traits than new undesirable traits assigned to this group, $F(1,71)=31.02$, $MSE.036$, p,.0001. A higher proportion of new undesirable traits than new desirable traits was assigned to Group B, but a one-way ANOVA for the false alarms for Group B indicated that this difference did not reach significance, $F(1,71)=3.09$, $MSE=.050$, $p<.08$. There was again no significant interaction between group, trait type, and cognitive load, $F(2,69)=.902$, $MSE=.008$, showing that illusory correlation did not vary significantly as a function of the cognitive load at encoding.

Frequency judgment. The trait frequency estimation task was used to measure illusory correlation in evaluative judgment. Three separate t-tests were conducted for the phi-freq scores, to determine whether the coefficients for each encoding condition were significantly greater than zero. The value of phi-freq for the low cognitive load condition was not significantly different than zero, $M=-.004$, $t(23)=-.056$. The value of phi-freq for the medium cognitive load condition was marginally different than zero, $M=.113$, $t(23)=1.9$ and the value of phi-freq for the high cognitive load condition was significantly different from zero, $M=.198$, $t(23)=2.81$. These t-tests thus show that there was no illusory correlation present in the low cognitive load condition, but as cognitive load increased, illusory correlation increased. However, a one-way ANOVA conducted to examine the effect of cognitive load on the phi-freq scores indicated that the amount of illusory correlation present did not vary across cognitive load conditions, $F(2,69)=2.30$, $MSE=.493$. Planned comparisons of the means for the three conditions showed a significant difference between only the low and high cognitive load conditions (Mean Difference = -.202).

Affective rating. Means for affective ratings are shown in Table 3. A 3 (Cognitive Load Condition: Low vs. Medium vs. High) X 2 (Social Group: A vs. B) ANOVA was done on the affective ratings for the two social groups. There was no main effect of cognitive load, $F(2,69)=.167$; $MSE=.146$, and no main effect of group, $F(1,69)=3.145$, $MSE=7.563$, but the interaction between group and load was marginally significant, $F(2,69)=1.46$, $MSE=3.52$, $p < .08$. This interaction effect was due to lower liking ratings for Group B than Group A in the high cognitive load condition, $F(1,23)=5.208$, $MSE=12.00$, $p <.032$.

Chapter 5

Discussion

This experiment was designed to examine the effects of cognitive load on illusory correlation. Specifically, its purpose was to add support to either the distinctiveness-based view or the differential meaning view of illusory correlation by looking for differences in the magnitude of illusory correlation following different levels of cognitive load during encoding. However, the findings do not allow conclusive statements to be made about the effect of cognitive load on illusory correlation.

A trait recognition task was used to measure the amount of illusory correlation in memory. Phi scores were computed from the total number of original desirable and undesirable traits (i.e., hits + mismatch errors) assigned to Groups A and B. For these scores, there was no illusory correlation in the low cognitive load condition, but illusory correlation was present in both the medium and high cognitive load conditions. Despite these differences, direct comparison of these scores indicated that the amount of illusory correlation present did not vary as a function of the amount of cognitive load at encoding. A subsequent examination of mismatch errors indicated that in all three cognitive load conditions, participants tended to assign desirable traits originally paired with Group B to Group A (see Figure 1) and assign undesirable traits originally paired with Group A to Group B. However, this illusory correlation effect did not vary among the cognitive load conditions.

The analysis of false alarms followed a somewhat similar trend. Overall, there were more false alarms for Group A than for Group B. There were also more false alarms for desirable traits than for undesirable traits. More importantly, new desirable traits were more often attributed to Group A and new undesirable traits were more often attributed to Group B (see Figure 2). However, this illusory correlation effect again did not vary as a function of the cognitive load condition.

The trait frequency estimation task and the affective rating task were used to measure illusory correlation in evaluative judgment. The affective ratings for Group B were lower than those for Group A in the low cognitive load condition, but the interaction between group and cognitive load was not reliable. For phi scores computed from trait frequency estimates there was no evidence of illusory correlation in the low cognitive load condition. Illusory correlation was present in the medium cognitive load condition, though phi scores in this condition were only marginally different from zero. In contrast to the low and medium load conditions, there was clear evidence of illusory correlation in the high cognitive load condition. Further analysis showed that phi scores did not vary significantly between the low and medium conditions or the medium and high conditions, but illusory correlation was greater in the high cognitive load condition than in the low cognitive load condition. To summarize, there was no illusory correlation in the low cognitive load condition for either phi-mem, phi-freq, or affective ratings. However, in the high cognitive load condition, illusory correlation was present, suggesting that the increased level of cognitive load at encoding had some impact on the amount of illusory correlation in memory and judgment.

The main prediction in this experiment was that the levels of illusory correlation would vary in response to cognitive load during encoding. Specifically, two hypotheses were tested. The first hypothesis was derived from the distinctiveness-based theory of illusory correlation (Hamilton & Gifford, 1976) and the second was derived from the differential meaning view of illusory correlation (Spears & Haslam, 1997). The distinctiveness-based theory of illusory correlation is based on the assumption that distinctive stimuli will stand out in memory. Since undesirable traits paired with members of Group B was the pair combination seen least by participants, this combination is distinctive and stands out in memory. In contrast, the differential meaning theory of illusory correlation suggests that the bias in judgment and memory occurs because participants try to find some meaningful difference between the two social groups and the trait difference is the most salient of the possible group differences. Both of these theories state that there will be no illusory correlation in the low cognitive load condition. The absence of illusory correlation is expected because in the low cognitive load condition, participants will be able to fully concentrate on the stimuli and should thus be able to encode most of the stimuli accurately. As a result, they should be able to make fairly accurate judgments and illusory correlation will be minimal.

The distinctiveness-based view suggests that illusory correlation should be higher in the medium load condition and higher still in the high cognitive load condition. This is suggested because as cognitive load increases, participants will encode only the distinctive stimuli accurately in memory. This bias during encoding should lead to a monotonic increase in illusory correlation across the three cognitive load conditions (Spears & Haslam, 1997). The differential meaning view also suggests an increase in illusory correlation in the medium cognitive load condition (Spears & Haslam, 1997). However, according to this view, the increase occurs for a different reason. Specifically, in the medium cognitive load condition, participants will not be able to devote all of their attention to the stimuli, yet they will continue to search for differences between the two social groups. In the high cognitive load condition, such a large portion of the cognitive resources is being used for the secondary task, participants will have few remaining resources to devote to differentiating social differences between the groups. For this reason, illusory correlation effects should not occur.

With the distinctiveness-based view, there should be a monotonic increase in illusory correlation with increasing cognitive load, whereas with the differential meaning view, there should be a curvilinear relationship between cognitive load and illusory correlation. However, this experiment did not provide conclusive support for either of these views as neither of these patterns was observed in the data. There was no significant increase in illusory correlation between the low and medium cognitive load conditions, nor was there a significant increase or decrease between the medium and high load conditions. On the other hand, the evidence of greater illusory correlation in the high cognitive load condition does not support the differentiated meaning hypothesis, while the evidence of an increase in the amount of illusory correlation from the low to the high cognitive load conditions does lend some weak support to the distinctiveness-based view of illusory correlation. However, the failure to obtain significant differences in illusory correlation between the three successive cognitive load conditions prevents firm conclusions about the appropriateness of the distinctiveness-based theory.

Although the present findings do not provide a definitive answer to the question of which theory best explains the illusory correlation effect, they do show illusory correlation in memory and evaluative judgment when participants were making decisions about two social groups. These results were consistent with previous research in this area. For example, the current study provided evidence for illusory correlation in memory using a trait recognition task, which has been used in two other experiments (Mutter, 2000; Pryor, 1986) with similar results. Likewise, consistent with findings from studies by Hamilton and Gifford (1976), Hamilton, Dugan, and Trolier (1985), Johnson and Mullen (1994), and Mutter, the present findings revealed illusory correlation in frequency estimation. Illusory correlation was also present in affective ratings, but only for the high cognitive load condition. This finding differs from the outcome of research by Hamilton and colleagues, Mutter, and Mullen and Johnson who all found evidence of illusory correlation in evaluative judgment using this task under lower cognitive load conditions. It is not clear why illusory correlation was not observed in the affective rating task in the medium cognitive load condition in the current research.

Several studies have attempted to study the effect of cognitive load on illusory correlation by manipulating mood, or presentation time, or by varying the number of stimuli presented. However, none of these methods increases cognitive load at the time of encoding. Slugoski, Sarsan, and Krank (as cited in Spears & Haslam, 1997) doubled the set size of the stimulus sentences and Spears and Haslam (1997) manipulated cognitive load by varying presentation duration of the stimulus sentences. Stroessner and colleagues (Stroessner et al., 1992) claimed that by manipulating mood they were manipulating cognitive load. It is not completely clear that the procedures used in these earlier studies were acceptable ways to manipulate cognitive load.

Mutter (2000) has conducted a study that effectively manipulated cognitive load requirements during encoding. In this study, she used a procedure similar to Hamilton & Gifford's (1976), but introduced a divided attention manipulation. Specifically, participants in a low distraction condition were allowed to concentrate solely on the stimuli sentences during encoding, whereas participants in a distraction condition performed a second task while encoding the stimuli. Results suggested that diverting resources during encoding produced stronger illusory correlation bias in group impressions. However, this experiment did not include a high cognitive load condition and thus provided no way to distinguish between the monotonic relationship between load and illusory correlation proposed by the distinctiveness-based view and the curvilinear relationship proposed by the differentiated meaning view.

Like Mutter (2000), the present experiment attempted to measure illusory correlation for different levels of cognitive load by requiring participants to perform a secondary-task, but the current research attempted to manipulate load for three different levels rather than two. This experiment provided results similar to results from Mutter's research, suggesting that illusory correlation does fluctuate as cognitive load increases. However, this manipulation failed to clearly distinguish between the distinctiveness-based and differential meaning theories of illusory correlation and this could be a result of problems with the secondary tasks used in this study. It is possible that there was not enough difference between the levels of cognitive load produced by the secondary task to reveal effects on illusory correlation. During the low cognitive load condition, participants concentrated on only the visual stimuli, in the medium load condition, they concentrated on the visual stimuli while listening for odd digits, and in the high cognitive load condition, participants concentrated on the visual stimuli while listening for a string of three consecutive odd digits. These secondary tasks were adapted from procedures used by Mulligan and Hartman (1996) and Park, Smith, Dudley, and Lafronza (1989) specifically because they used a different modality (auditory) than the primary encoding task (visual) while offering a possible way to vary levels of cognitive load. The task of monitoring for one odd digit seems to be less cognitively demanding than monitoring for three consecutive odd digits (Park et al., 1989; Mulligan & Hartman, 1996). In the former task, participants are required to listen for odd digits, but were not required to store any information about those digits in memory, whereas, in the latter task participants are required to listen for odd digits and simultaneously store information about those digits in memory (was it odd or even and how many odds have been presented consecutively). It was expected that this manipulation would increase the cognitive load between the medium and high load conditions. However, it is not clear whether these secondary tasks did in fact produce three distinct levels of cognitive load. Before additional research on the effect of cognitive load on illusory correlation is done, some time should be spent examining ways to effectively manipulate cognitive load in this context.

In conclusion, this research has shown evidence of illusory correlation in social cognition that is consistent with previous research (Hamilton & Gifford, 1976; Hamilton et al., 1985; Johnson & Mullen, 1994; Pryor, 1986; Mutter, 2000). The current research also provided evidence that illusory correlation fluctuates as cognitive load increases, which is consistent with earlier findings. In addition, the increase in the amount of illusory correlation between the low and high cognitive load conditions provides some weak evidence for the distinctiveness-based view of illusory correlation. The reasons for the lack of more conclusive evidence are not clear, but one possibility is methodological problems in the way that cognitive load was manipulated. However further research should be conducted with secondary tasks in the illusory correlation paradigm to determine whether the finding that illusory correlation increases as cognitive load increases can be substantiated. This theoretical question is an interesting one that also has practical implications. Illusory correlation biases not only play into the public perception of social groups, but based on previous research (Chapman & Chapman, 1967; Gyns, Willis & Faust, 1994), these errors in judgment can be made by professional psychologists in the clinical and school settings. By studying situations when illusory correlation is present and the variables that lead to increases in this bias it, may be possible to decrease its influence in judgment.

References

Berndsen, M. & Spears, R. (1997). Reinterpreting illusory correlation: From biases covariation to meaningful categorization. *Swiss Journal of Psychology, 56,* 127-138.

Chapman, L. J. (1967). Illusory correlation in observational report. *Journal of Verbal Learning and Verbal Behavior, 6,* 151-155.

Chapman, L. J., & Chapman J. P. (1967). Genesis of popular but erroneous psychodiagnostic signs. *Journal of Abnormal Psychology, 72,* 193-204.

Francis, W. N., & Kucera, H. (1982). *Frequency analysis of English usage: Lexicon an grammer*. Boston: Houghton Mifflin.

Gyns, J. A., Willis, W. G., & Faust, D. (1995). School psychologists' diagnoses of learning disabilities: A study of illusory correlation. *Journal of School Psychology, 33,* 59-73.

Hamilton, K. L., Dugan, P. M., & Trolier, T. K. (1985). The formation of stereotypic beliefs: Further evidence for distinctiveness-based illusory correlation. *Journal of Personality and Social Psychology, 48,* 5-17.

Hamilton, K. L., & Gifford, R. K. (1976). Illusory correlation in interpersonal perception: A cognitive basis of stereotypic judgments. *Journal of Experimental Social Psychology, 12,* 392-407.

Haslam, S. A., McGarty, C., & Brown, P. M. (1996). The search for differentiated meaning is a precursor to illusory correlation. *Personality and Social Psychology Bulletin, 22,* 611-619.

Johnson, C., & Mullen, B. (1994). Evidence for the accessibility of paired distinctiveness in distinctiveness-based illusory correlation in stereotyping. *Personality and Social Psychology Bulletin, 20,* 65-70.

Kaufman, A. S. (1979). *Intelligent testing with the WISC-R.* New York: Wiley Interscience.

Kavale, K. A. (1984). A meta-analysis of the validity of Wechsler Scale profiles and recategorizations: Patterns or parodies? *Learning Disability Quarterly, 7,* 136-156.

McGarty, C., & de la Haye, A. (1997). Stereotype formation: Beyond illusory correlation. In R. Spears, P.J. Oakes, N. Ellemers, and S. A. Haslam (Eds.), *The social psychology of stereotyping and group life* (pp.171-207). Oxford, UK: Blackwell Publishers.

McGarty, C., Haslam, S. A., Turner, J. C., & Oakes, P. J. (1993). Illusory correlation as accentuation of actual intercategory difference: Evidence for the effect with minimal stimulus information. *European Journal of Social Psychology, 23,* 391-410.

Mulligan, N. W., & Hartman, M. (1996). Divided attention and indirect memory tests. *Memory & Cognition, 24,* 453-465.

Mutter, S. A. (2000). Illusory correlation and group impression formation in young and older adults. *Journal of Gerontology, 55B,* 224-238.

Park, D. C., Smith, A. D., Dudley, W. N., & Lafronza, V. N. (1989). Effects of age and a divided attention task presented during encoding and retrieval on memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 1185-1191.

Pryor, J. B. (1986). The influence of different encoding sets upon the formation of illusory correlation and group impressions. *Personality and Social Psychological Bulletin, 12,* 216-226.

Spears, R., & Haslam, S. A. (1997). Stereotyping and the burden of Cognitive Load. In R. Spears, P.J. Oakes, N. Ellemers, and S. A. Haslam (Eds.), *The social psychology of stereotyping and group life* (pp.171-207). Oxford, UK: Blackwell Publishers.

Stroessner, S. J., Hamilton, D. L., & Mackie, D. M. (1990). Affect and stereotyping: The effect of induced mood on distinctiveness-based illusory correlations. *Journal of Personality & Social Psychology,62,* 564-577.

Table 1

Analysis of Variance for Mismatch Errors

Source	df	SS	MS	F	p	Power
Load (L)	2	.211	.106	2.658	.077	.500
Subject (S)	69	2.742	.040			
Group (G)	1	.473	.473	14.174	.000	.975
G x L	2	.124	.062	1.863	.163	.363
G x S	69	2.301	.033			
Trait Type (T)	1	.060	.060	2.078	.154	.279
T X L	2	.075	.038	1.294	.280	.261
T X S	69	2.002	.029			
G X T	1	1.507	1.507	14.906	.000	.981
G X T X L	2	.185	.093	.917	.405	.195
G X T X S	69	6.976	.101			

Table 2

Analysis of Variance for False Alarms

Source	df	SS	MS	F	p	Power
Load (L)	2	.047	.023	.412	.664	.112
Subject (S)	69	3.912	.057			
Group (G)	1	.186	.186	8.069	.006	.813
G x L	2	.129	.065	2.813	.067	.526
G x S	69	1.588	.023			
Trait Type (T)	1	.222	.222	23.787	.000	1.000
T X L	2	.023	.012	1.247	.2937	.253
T X S	69	.645	.009			
G X T	1	1.056	1.056	13.406	.000	.966
G X T X L	2	.016	.008	.104	.9015	.065
G X T X S	69	5.434	.079			

Table 3

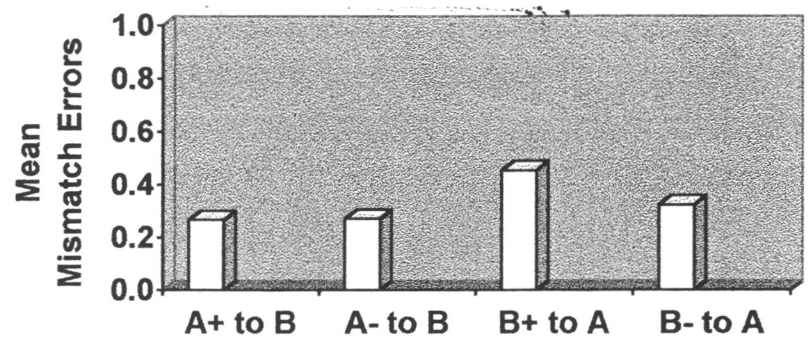
Mean Affective Ratings for Group A and Group B for Low, Medium, and High Cognitive Load

	Low		Medium		High		
Group	M	SD	M	SD	M	SD	M
A	4.25	1.33	4.50	1.14	4.87	1.15	4.54
B	4.33	1.44	4.04	1.20	3.87	1.40	4.08

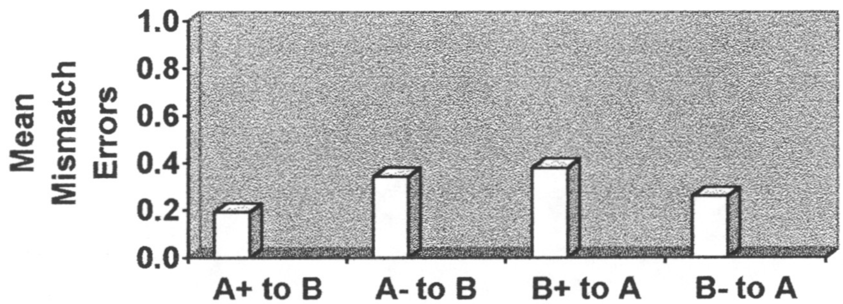
Figure Captions

Figure 1. Mean proportion of mismatch errors for low cognitive load, medium cognitive load, and high cognitive load conditions.

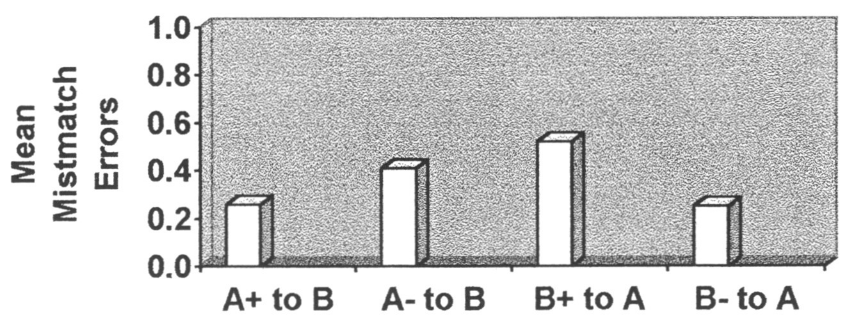
Figure 2. Mean proportion of false alarms for low cognitive load, medium cognitive load, and high cognitive load conditions.



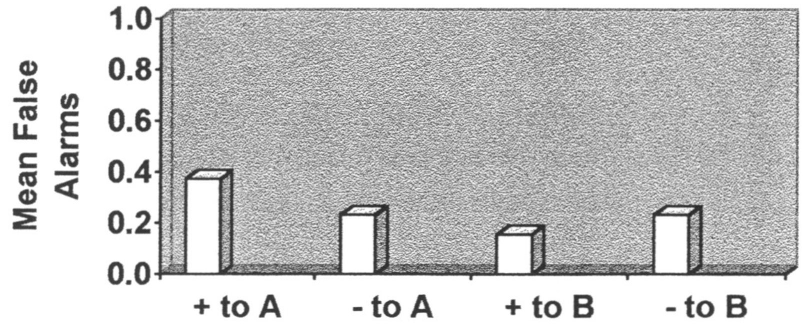
Low Cognitive Load



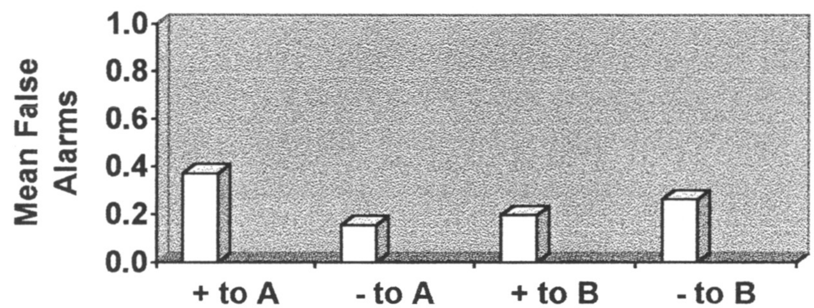
Medium Cognitive Load



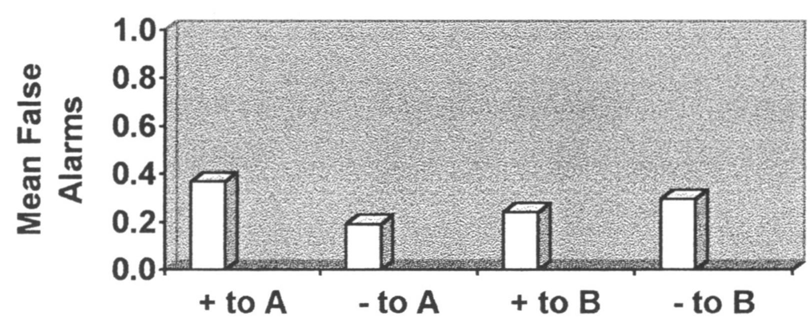
High Cognitive Load



Low Cognitive Load



Medium Cognitive Load



High Cognitive Load

Appendix A

Instructions read to participants

<u>Instructions Low Cognitive Load Condition:</u>

<u>Practice Condition (Easy Task)</u>

In this task, you are going to listen to an audiotape of a series of numbers. The numbers range from 1 to 10. Each time you hear an odd number you should to push the button on the counter. For example, if you hear the number 5 or you would push the counter button once. When you hear the word "STOP", push the stop button on the tape player (show the participants where the stop button is).

<u>Practice Condition (Difficult Group)</u>

In this task you are going to listen to an audiotape of a series of numbers. The numbers range from 1 to 10. Each time you hear three odd numbers in a row, you should push the button on the counter. For example, if you heard the numbers 7, 1, 9, you would push the counter button once. When you hear the word "STOP", push the stop button on the tape player (show the participants where the stop button is).

<u>Experimental Condition (Low Cognitive Load)</u>

This experiment is about how people process and retain information about members of different groups. You will see a series of descriptions of different people. For example you might see the statement: "Alex, a member of group A, is sincere. The people in the statements will be identified by their membership in a particular group. Each person described is a member of one of two groups which, to keep things simple, will be referred to as Group A or Group B. Both groups are real, although the names of the group members have been changed. The descriptions of the group members were generated by people who know them very well. For this experiment, the group members and their descriptions were drawn at random from the actual group population. In the real world Group B is smaller than Group A. Consequently, statements describing members of Group B occur less often than statements describing members of Group A.

As each statement is presented, read it carefully. This is important because later on we will ask you some questions about these statements.

<u>Instructions for Medium Cognitive Load Condition:</u>

<u>Practice Condition (Easy Task)</u>

In this task, you are going to listen to an audiotape of a series of numbers. The numbers range from 1 to 10. Each time you hear an odd number you should to push the button on the counter. For example, if you hear the number 5 or you would push the counter button once. When you hear the word "STOP", push the stop button on the tape player (show the participants where the stop button is).

<u>Experimental Condition (Medium Cognitive Load)</u>

This experiment is about how people process and retain information about members of different groups. You will see a series of descriptions of different people. For example you might see the statement: Alex, a member of group A, is sincere. The people in the statements will be identified by their membership in a particular group. Each person described is a member of one of two groups which, to keep things simple, will be referred to as Group A or Group B. Both groups are real, although the names of the group members have been changed. The descriptions of the group members were generated by people who know them very well. For this experiment, the group members and their descriptions were drawn at random from the actual group population. In the real world Group B is smaller than Group A. Consequently, statements describing members of Group B occur less often than statements describing members of Group A.

In the real world, we often receive information about people while we are doing other things. Therefore, in this experiment, you will be doing two different tasks as the statements about the group members are presented. One of your tasks will be to read each statement carefully. This is important because later on we will ask you some questions about these statements. The other task will be identical to the task you just finished. Specifically, you will be required to listen to an audiotape of a series of numbers. As you listen you will again have the counter in your hand and each time you hear an odd number you should press the button on the counter. We are interested in how accurately you can do this task, so after all the statements have been presented we will record the final counter value you have obtained. Please note, however, that both tasks you are doing are important. You should therefore read the statements carefully <u>and</u> count the odd numbers accurately.

<u>Instructions for High Cognitive Load Condition:</u>

<u>Practice Condition (Difficult Group)</u>
In this task you are going to listen to an audiotape of a series of numbers. The numbers range from 1 to 10. Each time you hear three odd numbers in a row, you should push the button on the counter. For example, if you heard the numbers 7, 1, 9, you would push the counter button once. When you hear the word "STOP", push the stop button on the tape player (show the participants where the stop button is).

<u>Experimental Condition (High Cognitive Load)</u>
This experiment is about how people process and retain information about members of different groups. You will see a series of descriptions of different people. For example you might see the statement: Alex, a member of group A, is sincere. The people in the statements will be identified by their membership in a particular group. Each person described is a member of one of two groups which, to keep things simple, will be referred to as Group A or Group B. Both groups are real, although the names of the group members have been changed. The descriptions of the group members were generated by people who know them very well. For this experiment, the group members and their descriptions were drawn at random from the actual group population. In the real world Group B is smaller than Group A. Consequently, statements describing members of Group B occur less often than statements describing members of Group A.

In the real world, we often receive information about people while we are doing other things. Therefore, in this experiment, you will be doing two different tasks as the statements about the group members are presented. One of your tasks will be to read each statement carefully. This is important because later on we will ask you some questions about these statements. The other task will be identical to the task you just finished. Specifically you will be required to listen to an audiotape of a series of numbers. As you listen you will again have the counter in your hand and each time that you hear three odd numbers in a row you should press the button on the counter. We are interested in how accurately you can do this task, so after all the statements have been presented we will record the final counter value you have obtained. Please note, however, that both tasks you are doing are important. You should therefore read the statements carefully <u>and</u> count the series of odd digits accurately.